

CLAIMS

What is claimed is:

1. A method for storing replacement data in a multi-way associative cache, comprising:
 - logically dividing the cache's cache sets into segments of at least one cache way;
 - searching a cache set in accordance with a segment search sequence for a segment currently comprising a way which has not yet been accessed during a current cycle of the segment search sequence;
 - searching the current segment in accordance with a way search sequence for a way which has not yet been accessed during a current way search cycle; and
 - storing the replacement data in a first way which has not yet been accessed during a current cycle of the way search sequence.
2. The method of claim 1, wherein a next sequential segment of the segment search sequence is considered when a segment currently being considered to receive replacement data is determined to not contain a way which has not yet been accessed during the current segment search cycle.
3. The method of claim 1, wherein a next sequential way of the way search sequence is considered when a way currently being considered to receive replacement data is determined to have been accessed during the current way search cycle.
4. The method of claim 1, wherein sequentially searching segments of the cache set comprises:
 - considering a current segment for storing replacement data until all ways in the current segment have been accessed during the current way search cycle; and
 - selecting for replacement consideration a next sequential segment in the segment search sequence.

5. The method of claim 4, wherein sequentially searching segments of the cache set further comprises:

repeating the considering and selecting for each segments in the segment search sequence.

6. The method of claim 1, wherein sequentially searching segments of the cache set further comprises:

repeating the segment search sequence when all segments of the cache set are determined to comprise ways which have been accessed during the current segment search cycle.

7. The method of claim 4, wherein considering a current segment for storing replacement data comprises:

searching way access indicators corresponding to ways of the current segment, wherein each way access indicator indicates whether a corresponding way has been accessed during a current way search cycle.

8. The method of claim 7, wherein selecting for replacement consideration a next sequential segment in the segment search sequence comprises:

setting the way access indicators corresponding to the current segment's ways to a value indicating the ways have not been accessed.

9. The method of claim 1, wherein selecting an available way further comprises:

prior to the searching of the cache set, determining whether a way of the cache set contains invalidated data; and

storing the replacement data in the way containing the invalidated data.

10. A method for managing a multi-associative cache comprising:
 - logically dividing each cache set of the cache into segments each comprising at least one cache way;
 - storing replacement data in an invalidated way, if any, in the cache set, in response to a cache miss, and setting, in response to a processor accessing the replacement data, a way access indicator corresponding to the accessed way to a value indicating the way has been accessed; and
 - selecting, when no invalidated way is in the cache set, a current segment of a segment search sequence for an available way; and searching the current segment in accordance with a way search sequence, for a next way not yet accessed during a current cycle of the way search sequence.
11. The method of claim 10, wherein when a way not yet accessed during a current cycle of the way search sequence is located, the method further comprises:
 - storing, replacement data in the located way.
12. The method of claim 11, wherein the method further comprises:
 - providing access to the way containing the replacement data.
13. The method of claim 12, wherein the method further comprises:
 - setting a way access indicator corresponding to the accessed way to a value indicating the way has been accessed.
14. The method of claim 10, wherein when a way not yet accessed during a current cycle of the way search sequence is not located, the method further comprises:
 - setting way access indicators corresponding to all ways in the current segment to a value indicating the ways are available.
15. The method of claim 14, wherein the method further comprises:
 - selecting a next segment in the segment search sequence as the current segment; and
 - repeating the segment search cycle.

16. The method of claim 10, further comprising:
 - providing, in response to a cache hit, access to the way containing the requested data;
 - and
 - setting a way access indicator corresponding to the accessed way to a value indicating the way was accessed.
17. A processing environment comprising:
 - a processor;
 - a multi-way associative cache;
 - a cache controller configured to logically divide the cache's sets into segments of at least one cache way, and comprising replacement logic that, in response to a cache miss, stores the replacement data in a way, if available, that contains invalidated data, and if not available, searches a cache set in accordance with a segment search sequence for a segment comprising a way which has not yet been accessed during a current cycle of the segment search sequence, and searches each segment in accordance with a way search sequence for a way which has not yet been accessed during a current way search cycle; and stores the replacement data in a first way which has not yet been accessed during a current cycle of the way search sequence.
18. The processing environment of claim 17, wherein the replacement logic considers a next sequential segment of the segment search sequence when a segment currently being considered to receive replacement data is determined to not contain a way which has not yet been accessed during the current segment search cycle.
19. The processing environment of claim 17, wherein the replacement logic considers a next sequential way of the way search sequence when a way currently being considered to receive replacement data is determined to have been accessed during the current way search cycle.

20. The processing environment of claim 17, wherein to sequentially search segments of the cache set, the replacement logic considers a current segment for storing replacement data and selects for replacement consideration a next sequential segment in the segment search sequence when all ways in the current segment have been accessed during the current way search cycle.

21. The processing environment of claim 20, wherein to consider a current segment for storing replacement data the replacement logic searches way access indicators corresponding to ways of the current segment, wherein each way access indicator indicates whether a corresponding way has been accessed during a current way search cycle.

22. A processing environment comprising:

means for logically dividing cache sets of a multi-way associative cache into segments of at least one cache way; and

means for storing, in response to a cache miss, replacement data in a way, if available, that contains invalidated data, and if not available, searches a cache set in accordance with a segment search sequence for a segment comprising a way which has not yet been accessed during a current cycle of the segment search sequence, and searches each segment in accordance with a way search sequence for a way which has not yet been accessed during a current way search cycle; and stores the replacement data in a first way which has not yet been accessed during a current cycle of the way search sequence.

23. The processing environment of claim 22, wherein the means for storing considers a next sequential segment of the segment search sequence when a segment currently being considered to receive replacement data is determined to not contain a way which has not yet been accessed during the current segment search cycle.

24. The processing environment of claim 22, wherein the means for storing considers a next sequential way of the way search sequence when a way currently being considered to receive replacement data is determined to have been accessed during the current way search cycle.

25. The processing environment of claim 22, wherein to sequentially search segments of the cache set, the means for storing considers a current segment for storing replacement data and selects for replacement consideration a next sequential segment in the segment search sequence when all ways in the current segment have been accessed during the current way search cycle.

26. The processing environment of claim 22, wherein to consider a current segment for storing replacement data, the means for storing searches way access indicators corresponding to ways of the current segment, wherein each way access indicator indicates whether a corresponding way has been accessed during a current way search cycle.